> **Instructions**: Complete each of the following exercises for practice.

1. Use the Lagrange multipliers method to compute the extreme values of f subject to the constraint.

   (a) $f(x, y) = xy;$ $4x^2 + y^2 = 8$

   (b) $f(x, y, z) = x^4 + y^4 + z^4;$ $x^2 + y^2 + z^2 = 1$

   (c) $f(x, y, z) = \ln(x^2 + 1) + \ln(y^2 + 1) + \ln(z^2 + 1);$ $x^2 + y^2 + z^2 = 12$

2. Find the extreme values of f subject to the constraints.

   (a) $f(x, y, z) = x + y + z;$ $x^2 + z^2 = 2,$ $x + y = 1$

   (b) $f(x, y, z) = xy + yz;$ $xy = 1,$ $y^2 + z^2 = 1$

   (c) $f(x, y, z) = x^2 + y^2 + z^2;$ $x - y = 1,$ $y^2 - z^2 = 1$

3. Find the points on the curve of intersection of the plane $x + y + 2z = 2$ and the paraboloid $z = x^2 + y^2$ which are nearest the origin and farthest from the origin.